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Subject Sch. gives for comparison series, 13.5; for test series, 12.5. There is therefore a slight backward association. As the authors remark, this may be due to the fact that the two syllables of a measure are treated by the mind as a group.

Experiments X. and XI. were designed to test Ebbinghaus' hypothesis that association of syllables can take place when they are simply stimulated in the proper order without actually appearing in consciousness. The saving in time he found in learning the second of two derived series when its syllables had been suggested in their proper order by the first, might be due to a certain preparation and not to actual association. There is a small probability that there is actual unconscious association.

Subject M. gives for comparison series, 13.62; for test series, 13.12.

Experiment XII. is concerned with the interference of associations, but gives no definite results and the work is still in progress. General observation seems to show that it is an influence of considerable importance, especially in learning new series.

According to experiment XIII. the first and second half of a series are learned equally well. A recent objection to the method, that repetitions and readings can't very well be coördinated is not valid, since the first part, which receives relatively more repetitions, is not learned either better or worse.

The authors call attention to the importance of rhythmic grouping for retention. The mind treats the syllables as units and their combination into measures as units of higher order. These again seem to be divided by cæsural pauses into groups of still higher order. The experiments may be taken as a demonstration of the common assertion that words are known as wholes.

There are several other matters of interest which space will not permit us to enter upon, such as the discussion of individual characteristics of memory, the tests for the various types, and the function of attention in such experiments.

BERGSTRÖM.

Über die Beeinflussung einfacher psychischer vorgänge durch einige Arzneimittel. DR. EMIL KRAEPLIN. 1892, 258 pages.

In this book the author summarizes the results of his well-known investigations, which were begun in Wundt's laboratory in 1882, upon the influence of drugs on mental processes, and gives an account of some later experiments by improved methods. The discussion is very full, since the aim is not simply to present certain data, but to develop an experimental method for the study of these and similar questions. The introductory chapter on methods is accordingly of great interest. The measurement of mental processes is especially liable to error. Not only does the general mental and physical condition influence the results, but fatigue and practice cause variations in the tests themselves. Such sources of error can only be taken into account by the most careful criticism and laborious repetitions of the experiments.

The chronoscope or "intermittent" method of studying mental processes, which was employed exclusively in the older experiments, is used in the later only where the aim is to study the qualitative as well as the quantitative changes of associations. With this exception, the continuous method was used in all the recent experiments and gives by far the most satisfactory results. It was first employed by Oehrn, at the suggestion of Prof. Kraepelin, for studying individual differences in rate, practice and fatigue. The subjects in the recent experiments with alcohol and tea were, with one exception, the same as those for Oehrn's

experiments. The normal records obtained in the latter are used for comparison with those obtained under the influence of drugs. The tests employed were reading, adding and learning twelve-place numbers. The subjects read, added or learned, two hours continuously, marking off every five minutes the amount done. The averages of the records for every fifteen minutes, give the picture of the changes the processes undergo. In some experiments twenty, in others thirty, grams of alcohol were taken at the end of the first half-hour. The changes afterwards in comparison with the records of the first half-hour and those of the normal series are attributed to the influence of the drugs.

The Hipp chronoscope proved to be the most serviceable for the intermittent experiments. In the later experiments upon association time, lip keys were used by both experimenter and subject, instead of Trautscholdt's method of making and breaking the circuit by hand simultaneously with the pronunciation of the word.

An important departure is made in the mathematical treatment of the results. Even the older protocols are worked over and presented in the new way. The arithmetical average is no longer, as in the earlier experiments, given as the most probable value of a group of observations, but rather the middle or central record. In the still later publication of Müller and Schumann upon memory, it will be observed that the middle record is also preferred. The reasons for substituting it for the arithmetical average in the treatment of psychometric observations seem on the whole well founded. The middle record is much less than the average disturbed by accidental influences, which, as is well known, have much greater power to lengthen than shorten records. The central zone, in which one-half the observations fall, cannot, as in the case of the average, be represented by the usual probable error with its double sign, but by two unequal values with different signs. These are found by subtracting the middle value of the whole group from the middle value of the upper and lower halves respectively.

Aside from the determination of the variability and sensory or motor character of mental work, the only way at present of studying the qualitative changes of mental processes is by classifying associations. The difficulties are very great. The rubrics chosen were: outer associations, including those of co-existence, sound and habitual expressions; and inner or logical. Practice will in a short time change cases of the second type into those of the first.

The later experiments are concerned chiefly with alcohol and tea.

The data for the study of alcohol comprise twenty-seven early experiments, ten each for simple and adaptive reactions, and seven for reactions with discrimination; three early series of association experiments and seventeen later ones. To these must be added twenty-seven experiments by the continuous method with seven subjects, ten each for adding and learning, and seven for reading. A few tests were also made with Ejner's time-estimating experiment and the dynamometer. From seven and a half to sixty grams of alcohol were given as doses.

The experiments with tea are about as numerous and were made in much the same way. With the exception of a few association lists, the experiments with other drugs belong to the early period of the work.

Small doses of alcohol have a stimulating effect upon reaction time, reading, and in some cases on the learning of the number series. This begins shortly after taking the dose and lasts twenty or thirty minutes, and is followed by a depression, or lengthening of

the records. Even in small doses it has a depressing effect at once upon adding and usually upon association; and in large doses, upon all the processes. The contrast in the effect of alcohol is greatest between simple reaction and reading, on the one hand, and reactions with discriminations and adding on the other. The other mental operations occupy an intermediate position, for some subjects showing acceleration, for others a depression. The two sharply contrasted classes contain the one, sensory and intellectual; the other, motor processes. The clue to the understanding of the results is the distinction between sensory and motor modes of reaction. Sensory and intellectual processes are depressed, but motor stimulated. The different results in learning number series are to be explained by the fact that it is a motor process for some and a sensory one for others. The dynamometer record is of the latter type, so only the rate and not the strength of movement is accelerated. The effect of tea is nearly the reverse. It stimulates the sensory and intellectual processes and depresses the motor slightly. The influence of ten grams of tea shows itself for about an hour. The effect of the other drugs differs greatly from that of these two in degree and duration, but otherwise the effect of morphine (.01 grams) is like that of tea; and the effect of small doses of ether, amylnitrite, chloroform and paraldehyde is like that of alcohol. An increase of sensory or intellectual activity is always accompanied by a motor depression. The author suggests this may be due either to a selective chemical effect of the drugs upon the parts of the nervous system connected with the sensory and motor functions, or it may be due to the removal of physiological inhibitions by the depression of the higher centres. The author's interpretation of his results is beautifully illustrated by the chart at the end of the volume. Since the curves do not stand for any special experiment, the choice of ordinates is of course somewhat arbitrary.

BERGSTROM.

Studies from the Yale Psychological Laboratory. Edited by E. W. SCRIPTURE, PH. D. Instructor in experimental psychology. Oct., 1893.

These studies are the results of the first year's work in the Yale laboratory established and directed by Dr. Scripture. The work includes the following studies:

1. *Investigations in reaction-time and attention*, by C. B. Bliss, Ph. D.
2. *On monocular accommodation-time*, by C. E. Seashore.
3. *On the relation of reaction-time to variations in intensity and pitch of the stimulus*, by M. D. Slaterry, M. D.
4. *Experiments on the musical sensitiveness of school children*, by J. A. Gilbert.
5. *A new reaction-key and the time of voluntary movement*, by E. W. Scripture and John M. More.
6. *Drawing a straight line; a study in experimental didactics*, by E. W. Scripture and C. S. Lyman.
7. *Some new psychological apparatus*, by E. W. Scripture.

The conclusions reached in the first part of the first study were:

1. No difference in reaction-time was found when the color of the light present in the field of vision was changed.
2. No difference was found in the times of reactions in the dark and those made while looking at a stationary incandescent light of six candle-power.
3. With the light in motion, the reaction-time was lengthened.
4. No difference was detected between the times of reactions in silence and those made while listening to the steady sound of a tuning-fork making 250 vibrations per second.
5. When the intermittent sound of a metronome was substituted for the fork, the time for reactions was lengthened.
6. The reaction to a sound heard in both ears is